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## *Description and Use of the Sliding Gunter in Navigation*

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*Thomas (Tom) Wyman*

The Dutch have a long and proud sea-faring tradition, which is reflected in many ways. For roughly a century, from 1570 to 1670, mapmakers in the Low Countries produced some of the greatest maps in the world. The centers of production, at first in Antwerp and Duisburg, soon shifted to Amsterdam. The Dutch maps and sea charts of this period have never been surpassed for their magnificence of presentation, richness of decoration, and accuracy based on information available at the time. Names of the near-legendary map-makers of the period include: Abraham Ortelius (1527-1598), Gerard Mercator (1512-1600), Jodocus Hondius (1563-1611) and

his son Henry Hondius, Willem Janszoon Blaeu (1571-1638) and his two sons, Joan and Cornelis, and finally Jan Janson (1596-1664).

As an aside, the Dutch proved to be powerful allies of the English in promoting the concept, attributed to mathematician Henry Briggs, that California was an island off the western coast of the New World. This was a cartographic misconception that prevailed for over 100 years; from 1620 until well after 1701 when Father Eusebio Francisco Kino, a Jesuit priest from Spain showed conclusively that California was not an island.



**FIGURE 1.**  
First page of Janssonius atlas

The first page of an atlas produced by mapmaker Johannes Janssonius in 1620 reflects the keen awareness of the Dutch to marine-related activities. Looking closely we see a group of mariners with all manner of globes, sea charts and atlases, a cross staff, an astrolabe, dividers, a compass box, and hour glass. The entire setting has an imposing sea scene as background. The bookseller who was offering this rare maritime atlas with 40 double-page charts was asking

£70,000!

With the long maritime tradition of The Netherlands, this paper on sliding Gunter's was most appropriately first presented in Leiden at IM 2010, which the Dutch hosted. This paper is a modified version and incorporates additional information.

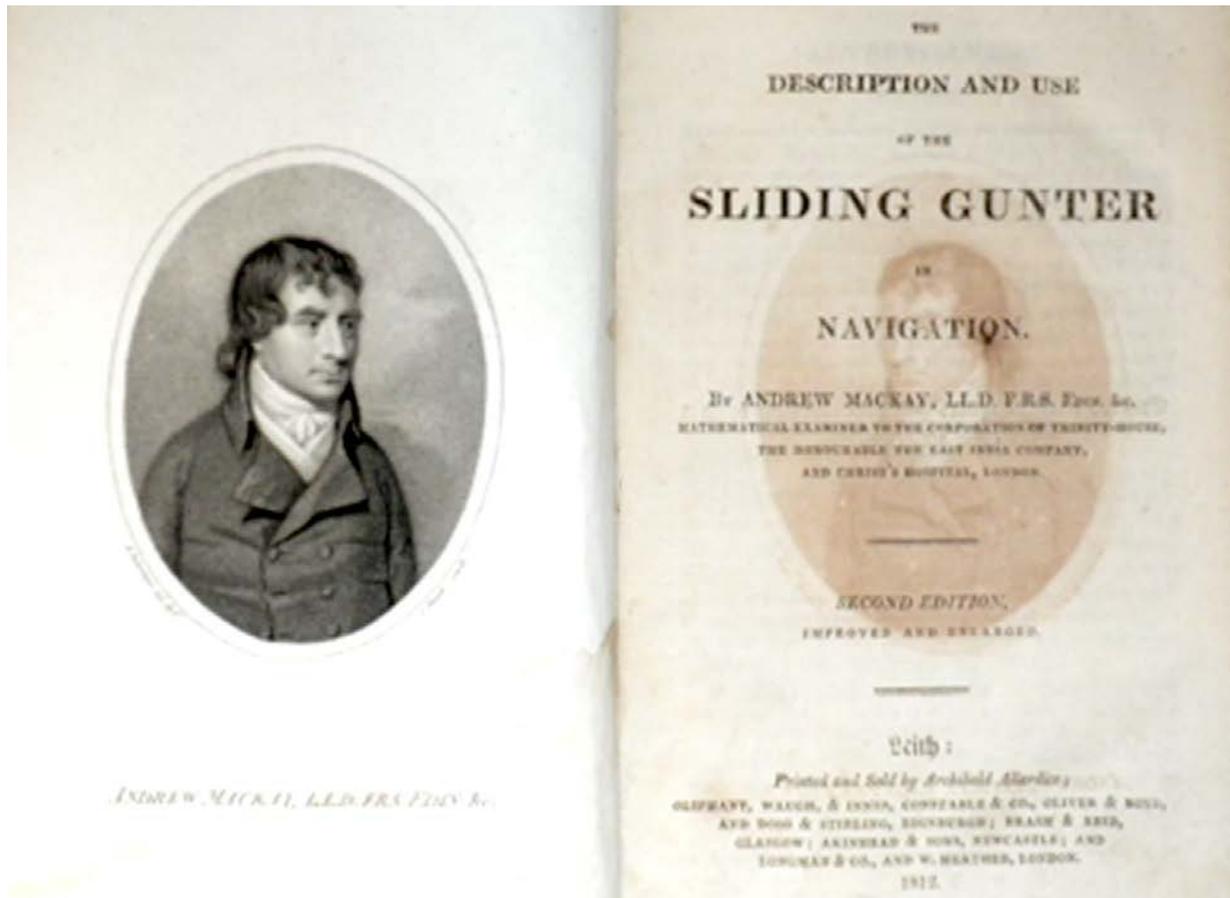
A sliding Gunter, which was available to mariners, is shown in a foldout and described in Andrew Mackay's 2<sup>nd</sup>

edition of *The Description and Use of the Sliding Gunter in Navigation*. The 2nd edition of Mackay's book, published posthumously in 1812, substantially altered and improved the 1st edition[1]. The lead-in "Advertisement" contained in the book offers some generalized comments on the sliding Gunter:

This is an instrument which has been used frequently at sea, but has been very little noticed of late by writers on navigation...Above fifty years ago, the Sliding Rule, was employed very generally at sea; and if it be less so at present, we can account for it in no other way, but from the difficulty of finding a treatise that contains directions and examples sufficiently plain and extensive to guide the mariner in his

use of it. This defect being so completely supplied by the present work, may we not reasonably expect, that the use of the Sliding Gunter will revive, and the method of performing the practical operations of navigation by it will again become general.

The 1st edition of Mackay's book appeared ten years earlier in 1802 and indeed may have served to encourage mariners to use the sliding Gunter. However, judging from the foregoing comments that appeared in the 2nd edition, the use of the sliding Gunter had declined. There is no evidence that it found wider application as a navigational instrument following the appearance of the 2nd edition in 1812. The reasons for this lack of interest in slide rules designed for



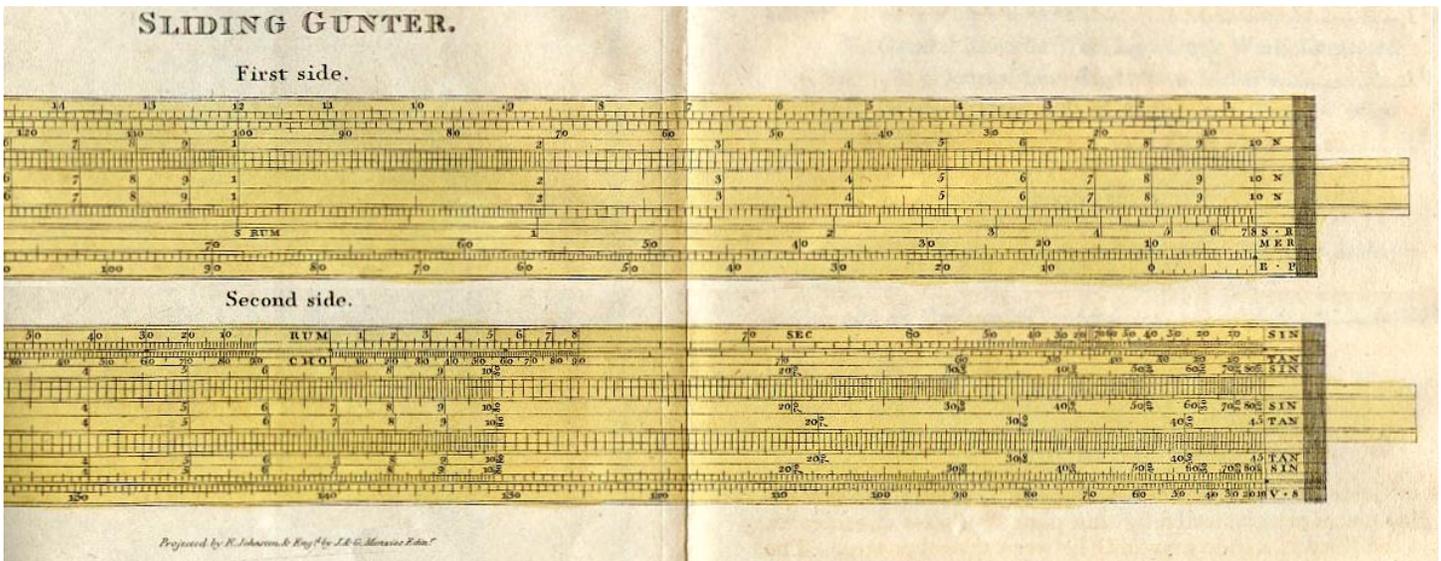
**FIGURE 2.**

**A Portrait of Andrew Mackay and his 2nd edition of *The Description and Use of the Sliding Gunter in Navigation* published posthumously in 1812**

use in marine navigation may never be known for certain, but we can make several calculated observations as to why this appears to be the case.

However, first we should understand how the sliding Gunter was meant to be used. After a few preliminary comments Mackay goes on to describe the instrument saying, "The length of the rule is either one, or two feet; that which

we shall more particularly describe, is two feet long, as being more accurate, than those of less size." In the first 18 pages the author instructs the reader on the use of the rule in solving basic arithmetic and trigonometric problems. The remaining 150 pages are devoted to the use of the Gunter Rule in solving a wide variety of navigational problems as well as providing specific instructions on maintaining a ship's log.



**FIGURE 3.**

**Pictured here is the sliding Gunter as shown in the foldout of Mackay’s book and described in the text. The foldout includes a small note “Projected by E Johnston & Eng<sup>d</sup> by J. & G. Menzies Edin.”**

The author has two 24-inch boxwood sliding Gunters, which have no maker’s name, but are essentially identical to that pictured above. A navigational slide rule nearly the same as that shown above was produced by Isaac Bradford at 136

Minories, Tower Hill, London; his address from 1802 to 1822. If a reader of Mackay’s book wanted to obtain a sliding Gunter, this was very likely the maker whom he would have consulted.



**FIGURE 4.**

**A 24x1.9-inch sliding Gunter made of boxwood identical to the one shown in the foldout in Mackay’s book. Maker is not known but was probably Isaac Bradford at 136 Minories, London**

Mackay’s book is a most comprehensive work written for mariners and offers numerous examples and explanations for using the sliding Gunter to solve a range of navigational problems. For example, the following direct quotes offer examples of calculations that could be performed using this instrument:

- Given the Latitude and Longitude of two Places, to find the course and distance between them. Example: Required the course and distance from Flamborough-head, latitude 34° 11' N. and longitude 0° 19' E. to the Naze of Norway, in latitude 57° 56' N and longitude 7° 15' E? (p.39)
- Given the Course and Distance sailed from a known place, to find the Latitude and Longitude of the Place come to. Example: A ship from Cape Clear, in latitude 51° 18' N.

and longitude 11° 15' W. sailed S. E. ¼ S, 120 miles: Required the latitude and longitude come to? (p.49-50)

- Given the Latitude of two Places, and the Distance between them, to find the Course, and Difference of Longitude. Example: A ship from St. Alban’s Head, in latitude 50° 37' N. and longitude 2° 13' W, sailed 171 miles upon a direct course between the S. and W. and by observation is in latitude 48° 28' N.: Required the course steered, and longitude come to? (p.54)
- Windward Sailing is the method of gaining an intended port, by the shortest and most direct method possible, when the wind is in a direction unfavourable to the course the ship ought to steer for that port. Example: A ship is bound to a port 26 miles directly to the windward, the wind

being N. E. which it is intended to reach on two boards, the first being the larboard tack; and the ship can ly within 6 points of the wind: Required the course and distance on each tack? (p.64)

- Current sailing by the Sliding Gunter. The computations, in the two preceding chapters, have been performed upon the assumption that the water has no motion. This may, no doubt answer tolerably well in those places where the tides are regular; as then, the effect of the flood will nearly counterbalance that of the ebb. But in places where there is a constant current, or setting of the sea, towards the same point, an allowance must be made of the ship's place, arising therefrom. And the method of resolving those problems in sailing, in which, the effect of a current or heave of the sea, is taken into consideration, is called "Current Sailing." Example: A ship sailed S. W. by S. at the rate of 7 knots an hour: Required the course, and distance made good in 24 hours? Example: A ship bound from Dover to Calais, lying S. E. by E.  $\frac{1}{2}$  E. distant 21 miles, and the flood tide setting N. E.  $\frac{1}{2}$  E.  $\frac{2}{2}$  miles an hour: Required the course she must steer, and the distance to be run by the log, at 6 knots an hour, to reach her port? (p.66-68)

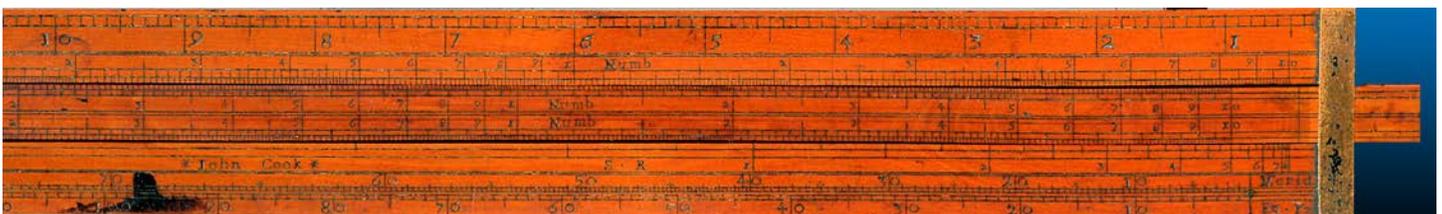
These examples are sufficient to suggest the versatility of the sliding Gunter. Indeed, the role of a ship's master and his navigator in assuring safe and direct passage from one port to another was not trivial. Ships were primitive and the navigational equipment of the period was rudimentary but still very practical. Consequently, any improvement in available navigational instrumentation should have been welcomed.

The truth is, however, that it seems unlikely that calculations such as those quoted above were performed routinely. More likely, mariners seldom strayed from waters with which

they were familiar with the result that over time they developed an "experience factor" or an intimate knowledge of the waters they plied. Mariners learned the courses to be sailed, the set of the sea and could assess prevailing wind and weather conditions as they set out and once underway would make adjustments accordingly depending on the weather conditions that developed. This knowledge was passed from generation to generation as young mariners learned the ways of the sea from their seasoned elders. Unlike today, mariners were never troubled by electronic communications and mid-course directives and destination changes from shore management. Once a ship set sail the destination generally remained unchanged.

Thus, although the sliding Gunter was an ingenious instrument applicable to solving many navigational problems, in reality such problems seldom arose in the routine voyages of the day. The "old salt" with his experience and knowledge of the waters he sailed had little need for a sliding Gunter and probably would not have been able to use it if, indeed, he had one. Given that the traditional ways of the sea change slowly, one can imagine that such instruments may even have been held in some disdain by seasoned mariners as a "gadget" that reflected the user's callowness and inexperience.

As noted earlier, the "Advertisement" to Andrew Mackay's 1812 edition comments on the sliding Gunter saying, "This is an instrument which has been used frequently at sea, but has been very little noticed of late by writers on navigation. Above fifty years ago, the Sliding Rule, was employed very generally at sea...." Representative of those earlier slide rules designed for navigators is a 12-inch boxwood and brass slide rule that was produced by John Cook. It has the appearance of an 18<sup>th</sup> century rule with small somewhat cramped numbering and lettering. This author has been unable to learn anything about the maker.



**FIGURE 5.**  
A boxwood and brass 12x1.6-inch sliding Gunter produced by John Cook. Circa 1760

The scales of this navigational rule by John Cook are as follows:

- The scales on the first side from top to bottom is 12-inch scale and two cycle log scale ("Numb") adjacent to the slide. There are two 2-cycle log scales (each marked "Numb") on the slide, with "S.R." and "Merid" scales and an arithmetic "Eq. P." scale on the lower edge of the first face.
- On the reverse side from top to bottom there is a "Rhumb" scale, "Chord" scale, "Sines" scale adjacent to the slide.

The slide has scales marked "Sines" and "Tangents." The lower body of the slide rule has "Tangents," "Sines", and "Tangent" scales.

This is an interesting example of a sliding Gunter. Overall, it does not appear to be an instrument that would be particularly easy to use, and the darkening of the patina over time would make it more difficult to read, especially where light was poor.

I do not intend these remarks of the comparative rarity

of the sliding Gunter to apply to the simpler one piece Gunter rule, which found much wider acceptance in the maritime community than did the sliding Gunter. Those seeking more information on the Gunter rule should refer to papers by Bruce Babcock [2], Dieter von Jezierski [3], and Otto van Poelje [4], [5]. In addition, a comprehensive description of sliding Gunters can be found in [6].<sup>1</sup>

One may speculate as to the reasons why the Gunter rule proved so much more enduring than the sliding Gunter. However, those reasons must include the rule's basic sim-

plicity combined with its versatility and the fact that calculations were readily made using mechanical dividers — instruments that every navigator had at hand and used regularly. Irrespective of other considerations, the rule must also have served as a convenient straight edge on the navigator's chart table.

An early volume, *Epitome of the Art of Navigation or, a Short, Easy, and Methodical Way to become a Competent Navigator*, published in 1762, mentions the Gunter "scale" in several places as an aid in solving certain calculations.

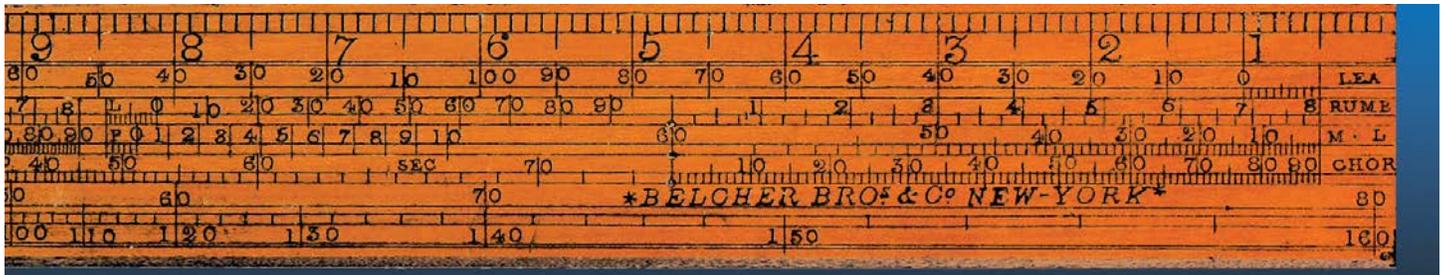


FIGURE 6.

The right hand portion of a 24-inch (60.96-cm) Gunter rule produced by Belcher Brothers & Co., New York. Circa 1855

This leaves a researcher today with the impression that the sliding Gunter, unlike the Gunter's rule, was not a particularly important item in the navigator's kit of instruments [7].

In his *The Art of Navigation in England in Elizabethan and Early Stuart Times*, D. W. Waters offers an interesting perspective on the importance of mathematical training as applied to navigation in the first half of the 17th century:

[W]hat was most necessary was for a man to have a good grasp of the principles of the sciences of geometry, trigonometry, and astronomy, and the ability to add, subtract, multiply, and divide simple figures accurately. In fact, by then navigation had developed far towards becoming a mathematical science. This is reflected in the manuals of navigation compiled after this date. All treat their subjects from the mathematical aspect.

This does not mean to say that by 1631 all masters were mathematicians and all practiced scientific navigation. Indeed many were poor mathematicians and even worse navigators. They had no standard qualifying examination to pass under the auspices of Trinity House, and in consequence many inherited and transmitted a deep distrust of "ciphers." But the successful navigators were far more numerous than is commonly averred; the growth of English commerce and colonization in the early seventeenth century and the success of naval operations in the mid-century wars with the Dutch alike vouch for this [8].

The very fact that there are comparatively few books that appear to have survived, which describe the use of the sliding Gunter in solving navigational problems, suggests that there were not many written in the first place. This also reflects the comparatively small market and limited use of the

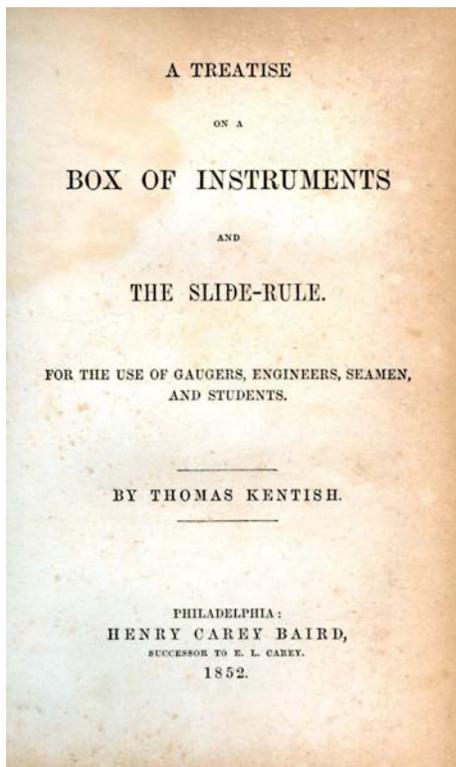
instrument among navigators. A review of the evidence leads one to conclude that the sliding Gunter was a specialized application of the slide rule that never found wide acceptance among mariners.

With respect to navigation in the Elizabethan and early Stuart times (mid-1600s to early 1700s) Waters also observed:

Just as today, so then the coaster practiced a simpler form of navigation than the deep sea trader. Much of the trade was still coastal. It follows that much of the navigation was coastal, and much of it pilotage. But to argue from this, as is often done, that the navigational knowledge of the period was rudimentary, and the practice unskillful, is to deny the evidence of the published books on the subject, of the exquisite accuracy of the surviving instruments, and above all, the meticulous entries of many a master mariner's journal [9].

Nathaniel Bowditch's well respected *The New American Practical Navigator: Being an Epitome of Navigation* was first published in 1802. This writer's copy, a well-worn 17<sup>th</sup> edition that appeared in 1847, has short chapters on both the "Gunter's Scale" and "Sliding Rule."

This book was first published in London and then in Philadelphia in 1852. This 228-page book includes ten sections (35 pages) on the use of the slide rule in solving various trigonometric problems related to navigation. This comparatively late addition to the literature on the use of the slide rule in making navigational calculations did not advocate the use of a particular slide rule but, instead, simply observed, "The trigonometrical slide is a slide containing the logarithmic sines and tangents, the former of which work to the line D, and the latter to the line A [10]."



**FIGURE 7.**

*A Treatise on a Box of Instruments and the Slide rule for the Use of Gaugers, Engineers, Seamen, and Students* by Thomas Kentish

Based on Bowditch and Kentish, slide rules were evidently considered marginally useful in navigation (at least by shore-based academicians) during the early and mid-1800s. On the other hand, in 1846 Edward Hazen wrote of the instruments employed by navigators but did not mention the Gunter rule or the sliding Gunter:

The instruments now employed in navigation, are the mariner's compass, the azimuth compass, the quadrant, the sextant, the chronometer, the half minute glass, the log, and the sounding line. In addition to these, the general navigator needs accurate maps and charts, lists of the latitude and longitude of every part of the world, the time of high water at every port, and a book of navigation, containing tables, to aid him in performing various calculations with facility; and, with a view to calculate the longitude by observation, he should be furnished with the nautical almanac, containing the places and declinations of the fixed stars and planets...[11]

Despite the writings of Bowditch and Kentish, the fact that Hazen makes no reference to the sliding Gunter supports the conclusion that by the mid-19<sup>th</sup> century the slide rule was never more than of peripheral importance as a navigational instrument. The sliding Gunter may have found a receptive market among some mariners some 100-years ear-

lier when it first appeared but fell into disuse as they found that they seldom if ever used the instrument or really needed it. The relative paucity of slide rules designed for making navigational calculations also supports the contention that they never became a widely-used navigational instrument.

Thus, we must conclude from available information that unlike technicians and engineers, who relied heavily on their slide rules during their working years, few mariners ever developed the same dependence and affection for the sliding Gunter designed for navigation. This esteem for slide rules among land-based technicians and engineers and general disdain among sea-going types of the sliding Gunter persisted over the years into the 20<sup>th</sup> century. We are left to conclude that the navigational slide rule never found an enduring role aboard ship.

#### Note

1. Mr. van Poelje's article served as the genesis for this paper, which builds on it to offer an assessment of the significance of the sliding Gunter in marine navigation.

#### References

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